Knoxville-Wide Housing Energy Efficiency Program

City of Knoxville Energy & Sustainability Initiative
Buildings Working Group

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OPPORTUNITY

The initiative proposed is to apply whole house weatherization techniques to buildings in the Knoxville vicinity in order to obtain sustainable and cost-effective energy savings. Initially the project would apply primarily to the residential energy sector, first to single family residences, small multi-family buildings, and mobile homes, but with potential for later expansion to larger multifamily buildings. In addition, the program could be expanded to commercial as well as industrial buildings in the future as ORNL has expertise in energy auditing and retrofitting these types of buildings as well.

This program could simultaneously use two fundamental approaches. Weatherization of existing homes at the time of the audit or shortly thereafter would result in immediate benefit to families while reducing the overall energy consumption in the Knoxville area. The second approach would be to conduct audits to identify potential energy and cost saving improvements which could be implemented at times the owners decide to remodel or when major repairs become necessary. Installing higher efficiency equipment, appliances, windows, etc., than might otherwise be purchased by the homeowner, or insulating walls when siding is to be replaced are examples of activities which can also reduce energy consumption. In addition, they lower the overall financial impact of the improvements since only the incremental costs provide the actual energy savings.

Weatherization programs have been shown to save as much as 25% or more in heating energy use. Based on the experience supplied by the Department of Energy Weatherization Assistance Program (DOE WAP), costs can range from $2,000 to $4,000 per household. Program evaluations have shown that weatherization programs are cost effective overall, with many measures having simple payback periods that are 8 years or less. As the existing housing stock continues to age, these opportunities for savings will remain if not increase with time.

Additional benefits of weatherization include increased community value, improved comfort to occupants, improved health and safety within the house, and reduced emissions, both at the site (home) and at the utility generation sites. The latter benefits have been quantified in several reports and can be worth as much if not more than the energy benefits. Either of the two approaches taken could be subsidized with home owner funds, utility funding, or other local sources.

The DOE WAP provides a basis on which to develop a strategy of implementation. Instituted in the mid 1970's, the Program has a substantial history of performance with several evaluations to

evidence its success. For example, the Program has produced a report, "Keys to Success: Ten Case Studies of Effective Weatherization Programs." Additional programs developed by utility companies as well as state and local energy efficiency organizations also provide examples. A consortium of electric utilities in Arkansas is designing a statewide program of weatherization using utility and Weatherization Program personnel.

PROGRAM DESIGN AND IMPLEMENTATION

In order to reach the widest audience and to make the most efficient use of available funding, the Housing Energy Efficiency Program would have two primary components:

- Weatherization Program – Trained energy auditors would inspect program homes to identify the cost-effective weatherization measures that would address space-heating energy use, air conditioning electricity use, and baseload energy use (water heating, lighting, and refrigeration). In addition, repairs needed to implement these measures and health and safety items related to these energy systems would be identified (e.g., roof repairs needed before attic insulation is installed, new doors needed to reduce air infiltration, flue repairs needed to natural gas furnaces and hot water heaters). Client education on their energy consumption systems and how to further reduce energy consumption would be a principal part of the program throughout all phases of the program's implementation (intake, auditing, weatherization, and final inspection). The program would be based on a whole-house energy approach; this means that the focus would not be on just one component of the house or one type of weatherization measure (e.g., space-heating system, insulation) but on all heat gain/heat loss sources, all the energy using systems, and how the occupants interact with these systems. Once measures are identified, trained/certified weatherization contractors would install the recommended measures. Trained energy inspectors would then verify that the recommended measures were installed and perform post-weatherization diagnostics to ensure that there are no remaining health and safety issues.

- Energy-Efficiency Repair/Replacement Program – Trained energy auditors would inspect program homes to identify major repairs/renovations that will be needed in the future (e.g., new roofs, new siding, new heating/air conditioning system, new water heater, new windows) and the incremental energy improvements that should be made at the time these repairs/renovations are performed (e.g., the amount and means of installing wall insulation before siding is installed, duct repairs needed before new heating/air conditioning equipment is installed, higher efficiency equipment above minimum standards). Trained/certified contractors would be available to perform the repairs and the incremental energy improvements when the occupant chose to perform them, and trained inspectors would verify that the work and recommendations were performed properly.

Both programs would be open to all city houses. For the weatherization program, low-income families might be subsidized in full while others might be subsidized only for the initial audit and final inspection provided that the recommended weatherization work is performed. For the repair program, the occupants would pay for the cost of the repair work itself with subsidies limited to

the audits, cost of the incremental energy recommendations, and final inspections. Again, lower-income families may receive more cost-sharing than others.

It is envisioned that the programs would initially focus on single-family site-built homes and mobile homes, with both small and large multifamily buildings addressed with a year or two after program start-up. By design, the repair program has a staged implementation in that repair items identified at the time of the audit may not be performed until several years later when the systems actual fail or when the occupants finally decide to address the maintenance issue.

Energy auditors and inspectors would need to be trained to support both programs. Although there are insulation, HVAC equipment, and other contractors in the City of Knoxville who could perform some of the work that would be recommended under both programs, contractor training and/or certification would still be required. It would be important to ensure that only qualified contractors who will perform the work to program specifications are used. Implementation of whole-house weatherization and repair requires a whole-house understanding of energy systems that most contractors do not currently have. In addition, some of the weatherization work and repairs that would be recommended will require skills that current contractors do not have (e.g., blower-door-guided air sealing, finding and sealing duct leaks using a duct blower, installation of high-density wall insulation, adding insulation properly to the floors and attics of mobile homes).

Design and implementation of these programs will require the partnership and participation of many organizations. These might include:

- Oak Ridge National Laboratory – Program design and training.
- TVA – Program design, training, and funding.
- KUB – Program design, training, funding, communication, and intake.
- Local community action agency – Program design, communication, intake, and implementation.
- Local contractors – Communication, intake, and implementation.
- City of Knoxville – Program design, funding, communication, and intake.
- Local Home Energy Rating System (HERS) raters – Program design, training, and implementation.
- National training organizations such as the Southface Energy Institute (Atlanta) and New River Center for Energy Research and Training (NRCERT, Blacksburg, Va.) – Program design and training.